Japanese Progress in LCA

Current Activities of the National LCA Project in Japan

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Abstract. The Ministry of International Trade and Industry (MITI) has launched a national project, 'Development of Assessment Technology of Life Cycle Environmental Impacts of Products' (commonly known as the LCA Project). The activities of this project will be continued for 5 yeas since fiscal 1998 with an overall budget of total 850 million yen. The LCA Project aims to develop a highly reliable LCA database and LCA methodology which can be readily used throughout Japan. In this paper, the overall plans and current activities of project are indicated.

Keywords: Database system; impact assessment; inventory data; LCA; national project

Introduction

The Ministry of International Trade and Industry (MITI) has launched a national project, 'Development of Assessment Technology of Life Cycle Environmental Impacts of Products' (commonly known as the LCA Project). The activities of this project will be continued for 5 yeas with an overall budget of total 850 million yen [1-2].

The LCA Project aims to develop a highly reliable LCA database and LCA methodology which can be readily used throughout Japan. It was launched in October 1998 with the participation of 56 expert committee members from industry, government and academia and 23 industry associations. The Inventory Study Committee, Impact Assessment Study Committee and Database Study Committee were established under the Project Steering Committee, which is in charge of overall planning and operation, in undertaking activities.

1 Objectives and Applications

The objectives of this project are to develop the following items:

- LCA methodology
- LCA public database for the whole of Japan
- Network system between data-input, data-base and user sites.

The applications of the results are expected in the following fields:

- For industrial production
  - Design for environmental products
  - Construction of eco-process
  - For marketing
  - Approval of eco-labeling,
  - Establishment of environment specification
  - Reflection in Environmental Administration
  - Green Purchasing,
  - Coping with COP3 Protocol, etc.
  - Acceleration of LCA popularization
  - Enrichment of textbooks for education
  - Training of LCA experts

2 Organization of LCA-Project

The Inventory Study Committee, the Database Study Committee and the Impact Assessment Study Committee have been set up; and the Administration Committee works to adjust the items of studies of the three committees and to preside over the overall activity (**Fig. 1**).

The **Inventory Study Committee** is divided into two working groups. **WG-1** consists of 23 industry associations (**Fig. 2**) which had been main members of the Japan LCA Forum, and collects the inventory data of each industrial products. **WG-2** discusses the LCI methodology of the recycling and disposal phase.

The **Database Study Committee** will establish the overall public database system based on the internet, the database itself and make the data input software.

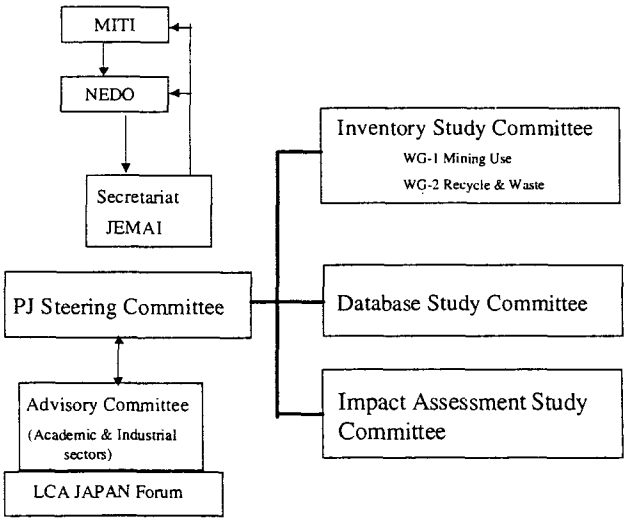

Fig. 1: Organization of LCA-Project

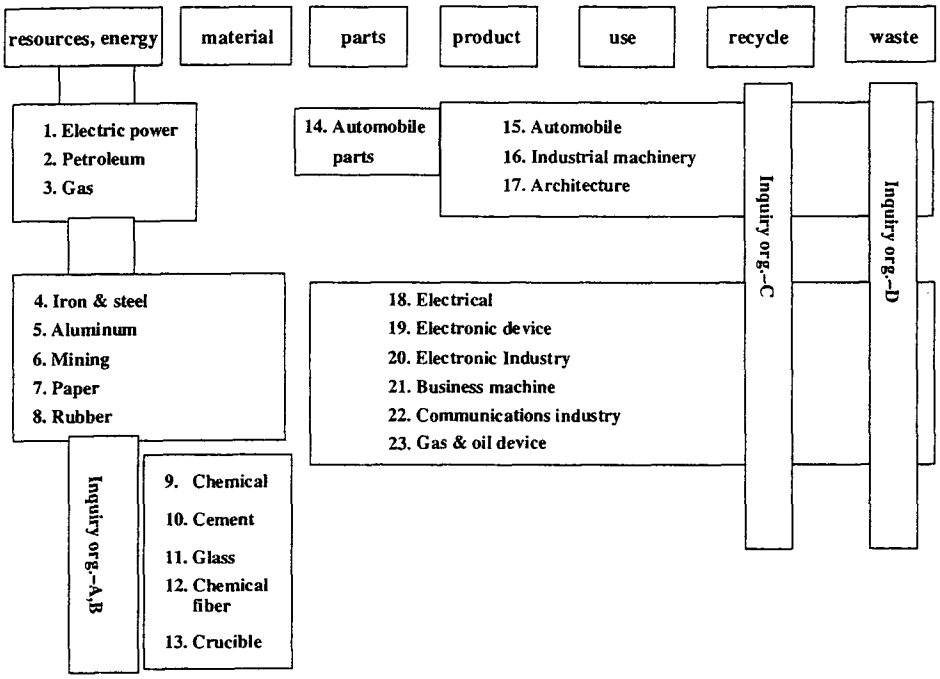

Fig. 2: Members from Industry Association

The Impact Assessment Study Committee will discuss and develop the Japan-version impact assessment methodology.

The activity of this project is independent of the Japan LCA Forum, but a close relationship has been kept through an Advisory Committee, newly organized within the Forum with veterans of universities, research laboratories and industries as members.

3 Overall and Current Activities of Each Study Committee

3.1 Inventory Study Committee

In order to construct the transparent and reliable inventory data, each industry group collects data by Summing-up Methods, and to supplement the unavailable data, calculations will be performed based on Input-Output Table, Statistics, and Process Models. As for the waste treatment or recycling system, inquiry companies will also make a search for the statistic and real material flow data. Data format will be basically in accordance with ISO 14040 and 14041.

3.1.1 Collection of inventory data (WG-1)

The data collection and input procedures were summarized as follows:

1) Preparation of format for inventory data arrangement
2) Study of inventory items
   - Selection of products to be subject to LCA from the Industrial Census and
   - Industrial Classification Code Table by the participant associations
   - Arrangement of product (service) subsystem flow
   - Selection of input-output substances (including environmental load substances) relating to the product manufacturing from the code table and recording them in the above-mentioned format.

Based on the collection of inventory items submitted by industry associations, the procedure is continued as follows:

3) Determination of the inventory items that can be collected by Summing-up Methods and of the responsible industry association
4) Arrangement of the overflow items – which are inventory items that cannot be dealt with by any industry association – and determination of the data collection method (process model method, input-output method)
5) Preparation of the inventory data collection criteria and collection of the data based on such criteria
6) Input of the inventory data by using the data input software
7) Data checking by each industry association

The above mentioned steps 1-5 and the data input trial (steps 6-7) were completed by the end of the fiscal 1998. As for the environmental load data, the following 14 substances were agreed to be collected or calculated: CO_2, CH_4, HFC, PFC, N_2O, SF_6, NO_X, SO_X, soot and dust, BOD, COD, total phosphorous, total nitrogen, suspended solids. Though these substances are not sufficient, other data like heavy metals and chemical substances are expected to be disclosed after the law of PRTR (Pollutant Release and Transfer Registers) is put in force.

Furthermore, the survey of data on resource mining, energy and transportation as common inventory items was commissioned to an investigation organization.

3.1.2 LCI methodology for recycling and waste treatment process (WG-2)

To establish the LCI methodology for the recycling and waste process, many items such as conceptual approaches, computational problems and waste treatment facilities were discussed.

In addition, a fact-finding survey has been conducted on the material flow of metals (iron, aluminum, copper, zinc, lead, cadmium, white metal, tin etc.), glass, paper and plastics.

A fact-finding survey on municipal and industrial waste was started with the aim of developing a LCI model for environmental load units during the final disposal. With regard to the first survey, data on five local governments were obtained and the approximate quantity of environmental load substances at the final disposal site was clarified. With respect to the second survey, however, the hoped-for data are still so difficult to gather that some adequate model may be needed.

3.2 Database Study Committee

In order to develop a LCA public database which is easily operable by users and easily maintainable and manageable by suppliers, the LCA database construction, database system and interface to LCA data access have been designed and constructed as shown in **Fig. 3**.

Typical inventory data formats used in foreign countries were studied, and a draft plan for data input format was presented. So far, the Database Study Committee had determined the basic specifications of the LCA database system and data input software, and ordered the design and creation to an expert company.

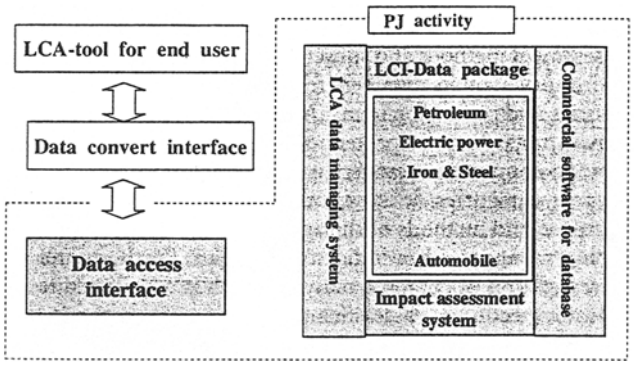

Fig. 3: Concept of LCA Database

3.2.1 Development of LCA database system

LCA database system is constructed as an integrated system of data input, data base and data providing to users through electronic means. Therefore, the overall database system will consist of

- Data input client
- Database server
- Data supply server.

During the current fiscal year, energy was channeled into 1) developing a data input software, 2) developing a database structure, and 3) studying the interface with the database server and the data supply server in order to accommodate the system above.

The database server which is the core of the system will store inventory data by using ORACLE. Retrieval function and management function are available. The database system offers a function that returns the results to the data supply server according to retrieval conditions as well as a function that manages and maintains a various database information.

The database will be managed by the membership system. Thus, the access is free to all members, which means to everybody who pays the membership fee.

3.2.2 Development of data input software

A software was developed to facilitate inventory data input and to enhance the efficiency of registration with the database system. The software was made to conform to the inventory data format used by the Inventory Study Committee. This format comprises a total of 130 items, which are widely classified into three major items for each product system, namely 'subsystem information', 'subsystem input data', 'subsystem output data' .

The functions of data input software prepared on the basis of these items can be classified into the following categories:

1) **Data input function:** inputs 'subsystem flow', 'subsystem information', 'input data', 'output data' and 'internal transport data' to express the product system configuration and inventory data.
2) **Dictionary maintenance function:** with respect to official names assigned to certain industry classification codes, registers the original name used by each industry and company as an alias.
3) **Import/export function:** offers import function to enable the use of data prepared by other applications by means of this input tool as well as export function that outputs CSV files that can be used with other applications. In addition, existing LCI data of each industry based on the Input-Output Table will be linked to this database for the convenience of client.

3.3 Impact Assessment Study Committee [3-4]

In order to establish a Japanese persuasive Impact Assessment Method, classification and characterization of environment-affecting substances will be summarized taking into account ISO 14042, 14043 and the environmental capacity of Japan. Furthermore, studies on valuation including damage estimation and aggregation will be conducted (**Fig. 4**).

3.3.1 Estimating method of the end point damage in various impact categories

There are numerous emission items that need to be taken into account in each category and numerous end points that need to be considered. Moreover, there is a variety of methods (models) for estimating end point damage, and there is a shortage of data which form the basis of these methods. By examining these conditions, the problems of utilizing the optimal damage estimation method conceivable in these circumstances were studied. In the future, it will be necessary to improve data collection and accuracy as well as to refine the methods.

During the couple of fiscal years, basic data were collected to estimate the damage caused by (1) global warming, (2) ozone layer depletion, (3) human toxicity and ecological

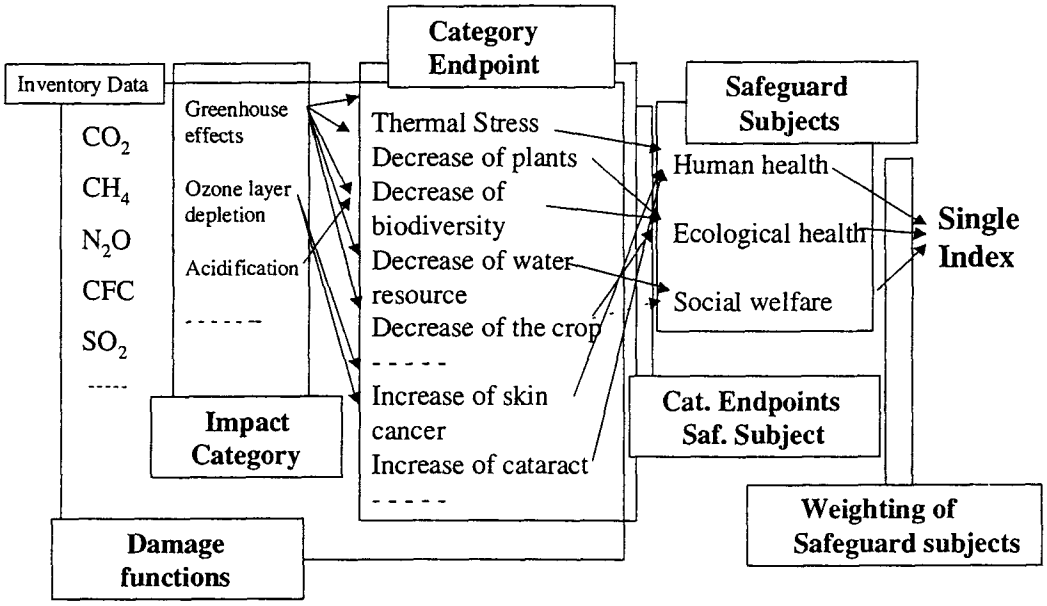

Fig. 4: Activities of Impact Assessment Committee

toxicity, and (4) photochemical oxidants, (5) acidification, (6) nutrient enrichment.

The procedure to calculate the damage function is as follows:

a) Selection of category end points
b) Extraction of processes (midpoints) to end points
c) Quantitative correlation between midpoints
d) Correlation (selection of damage function)with damage amount of category endpoints caused by emissions

3.3.2 Weighting methods between impact categories

In Japan, several studies have been conducted on the aggregation methods. Nevertheless, the conceptual approach and method of calculation of impact differs from each other. During the first fiscal year, various aggregation methods were compared by means of real calculation using the same inventory data. As shown in Fig. 5, this study revealed that even if the same inventory data are used, the environmental assessment results vary substantially depending on the method used. This gap can be attributed to a large discrepancy in the conceptual approach to environmental assessment (which protection items and impact categories are considered important).

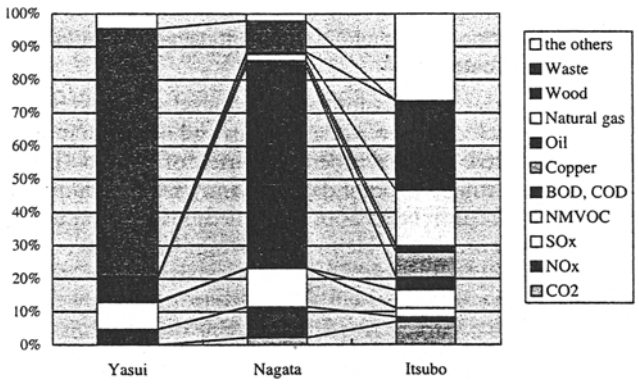

Fig. 5: Comparison of various impact assessment methods in Japan (used the same inventory data of copy-machine)

Aside from this case study, the Impact Assessment Study Committee determined what is vital in developing impact assessment methods and subsequently conducted a questionnaire survey on its members to study important impact categories and protection items. Although there was some consensus regarding the protection items, there was a big gap among committee members with regard to the selection of impact categories. It is essential to adequately debate the purpose and methods of the aggregation indicator in developing an aggregation indicator in Japan. Furthermore, an investigation of conjoint analysis which is considered to be a leading economic assessment method has been conducted and implemented a case study regarding air-conditioners. Conjoint analysis is a method of estimating the cost of lowering the emission of environmental load substances. This method is currently being studied, and it is necessary to conduct some case studies in the future.

4 Budget and Schedule

This project has a 5-year activity schedule. The main subjects, however, will be completed and available for actual use within three years. During the remaining two years, the research will be focused on the various case studies and the procedures of interpretation. With these studies, additional data supplement and system improvement is expected.

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